MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

EBI4016 – BIOELECTRIC

7 OCTOBER 2016
3:00 p.m. – 5:00 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 3 pages including cover page with 5 Questions only.
2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) Briefly describe bioelectricity and its origin

[4 Marks]

(b) State the four major factors that determine the permeability of a particle across a junction channel.

[4 Marks]

(c) Briefly describe the non-gated, chemically gated and voltage gated channels in terms of their locations and functions.

[6 Marks]

(d) Explain how bioelectricity propagation in the nerve is distinguished from current flow in electrical conducting cables.

[6 Marks]

Question 2

(a) Is it possible to measure bioelectric potentials by connecting standard electronic measurement instruments such as multimeter probes to the body of patient as we would usually do for the measurement of voltage from a power source? Explain your answer using justifications related to bioelectric potential, ionic flow, charge carriers and electrochemical reactions.

[8 Marks]

(b) Sketch the equivalent circuit of a biopotential electrode labeling and describing the individual components.

[4 Marks]

(c) Briefly describe how impedance of a typical biopotential electrode changes with frequency of the applied signal.

[4 Marks]

(d) Briefly describe half-cell potential and how it is measured.

[4 Marks]

Continued ...

Question 3

(a) Briefly describe an electrooculogram (EOG)

[2 Marks]

(b) Justify why there are differences between EOG and other bioelectric signals in terms of its origins and measurement methods.

[4 Marks]

(c) Recommend two ways to minimize the problems associated with EOG measurements.

[4 Marks]

(d) Briefly describe lead, unipolar lead and bipolar lead and sketch the bipolar limb leads electrode setup according to the 12-lead ECG system.

[6 Marks]

(e) Sketch a typical ECG waveform, distinguish the major waveform features, and relate those features with cardiac events.

[4 Marks]

Question 4

(a) Briefly describe what is meant by a cardiac action potential.

[4 marks]

(b) Describe the three phases involved in the generation of action potential of contractile muscle cells. Please ensure that you relate your answer in terms of the period of contraction and absolute refractory period in ventricular heart cells.

[10 marks]

(c) Sketch the membrane potential versus time graph depicting the three phases described in part (b) and clearly identify the regions of the three phases, absolute refractory period and tension development (contraction).

[6 marks]

Question 5

(a) Briefly describe the four desired characteristics of biopotential amplifiers.

[8 marks]

(b) State the advantages of using differential amplifiers in the conditioning of bioelectric signals.

[4 marks]

(c) Briefly describe how powerline interference appears on the human body.

[6 marks]

(d) Recommend two methods to minimize the noise in bioelectric signals, which occur because of powerline interference on the human body.

[2 marks]

End of Paper.